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ABSTRACT

Aptitude-treatment interaction research is designed to identify significant disordinal interactions between personological variables and alternative instructional programs. This study was designed to investigate the efficacy of the aptitude treatment interaction design to research seeking to identify differential educational payoff of alternative educational programming based on aptitude information. Four aptitude measures were administered to five first grade classes. Following pretesting, curricular interventions were instituted for six months. Class I received word-form configuration training. Class II received visual-perceptual training. Class III received language-conceptual training. Class IV served as a Hawthorne Group in which a resource teacher provided on-going emotional support to the regular teacher. Class V received no specific curricular intervention. Following the intervention phase, six measures were administered as post-tests. Analyses of variance revealed no significant aptitude-treatment interaction in any case. Factors believed to have contributed to the failure to produce significant disordinal interactions include: (1) non-normal distributions on the aptitude measures; (2) an inability to identify discernably different groups on the basis of the aptitude measures; (3) non-parallelism of pretest regression lines; and (4) low reliability for the aptitude and post-test measures. (KM)

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APTITUDE-TREATMENT INTERACTION RESEARCH WITH LEARNING DISABLED CHILDREN

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The very existence of "special" education is literally dependent on the identification of significant disordinal interactions between learner characteristics (specific personological variables) and the relative educational payoff of differential educational curricula or approaches. The ideal of individualized instruction remains simply an ideal if we are unable to reliably and validly identify specific learner aptitudes which interact with specific teaching strategies. Yet, educators continue to talk rather glibly about being involved in diagnostic-prescriptive teaching.

Although, theoretically, diagnostic-prescriptive teaching is both an enviable and desirable model, there is, to date, little empirical support for the model. Ysseldyke (1973) reviewed the state of the art in diagnostic-prescriptive teaching, concluding that the majority of the support for the diagnostic-prescriptive teaching concept was based upon the results of either descriptive(correlational) or gain-score research. The methodological problems inherent in both research designs were reviewed and it was concluded that correlational and gain-score results are inadequate sources to use in differentiating instruction. Aptitude-treatment interaction research designed to identify significant disordinal interactions between personological variables and alternative instructional programs was presented as an appropriate alternative design to be used in investigating curricular efficacy and diagnostic-prescriptive relationships.

The aptitude-treatment interaction design has not been applied specifically to special education and to diagnostic-prescriptive teaching of handicapped children. The aptitude-treatment interaction design itself, however, has been applied in limited fashion in educational, correlational, and experimental psychology. Cronbach (1957) urged psychologists from the experimental and correlational and disciplines to combine their efforts in an attempt to observe experimental effects for subjects of differing characteristics and to conduct investigations designed to identify aptitude-treatment interactions. Bracht (1970), however, reviewed 90 studies which could be characterized as aptitude-treatment interaction investigations, reporting that 85 of the 90 studies resulted in either non-significant or ordinal interaction.

Of five studies reported by Bracht involving handicapped children, all demonstrated ordinal or non-significant interactions. However, the five investigations reported involved comparisons of groups of children defined on the basis of their performance on factorially complex tests. The studies involved comparisons of "normal" and "mentally retarded" children and/or comparisons of "normal" and emotionally disturbed children.

Reynolds (1963, 1972) indicated a great need for research that demonstrates how aptitudes and instructional systems can be joined optimally in educating exceptional children. According to Bracht (1970), the goal of aptitude-treatment interaction research is identification of significant disordinal interactions between personological variables and alternative treatments. Aptitude information, per se, is likely to be of little value in attempts to adapt instruction unless it can be demonstrated that the aptitude interacts with specific modes of instruction, that is, unless the regression line relating aptitude to pay off under one method of instruction crosses the regression line for competing methods of instruction (Cronbach, 1967).

This study was designed to investigate the efficacy of the aptitude-treatment interaction design to research seeking to identify differential educational payoff of alternative educational programming based upon aptitude information. Two specific questions were raised: (1) Are current assessment devices sophisticated enough to identify aptitude strengths and weaknesses, and (2) Do children demonstrating specific aptitude strengths or weaknesses attain instructional objectives more effectively using differential instructional programming?

Method

The research design was a static group comparison in which four aptitude measures were administered to five first grade classes and five different curricular interventions were then instituted. Aptitude measures included the Primary Mental Abilities Test, an experimental Word-Form Configuration Test (Sabatino, 1970), the Marianne Frostig Developmental Test of Visual Perception, and the Developmental Test of Visual Motor Integration (Beery-Buktenica, 1969).

Following pre-testing, curricular interventions were instituted for six (6) months. Class I received word-form configuration training using the word-form program designed by Sabatino (1970). The program, in 29 workbooks, begins with gross form discrimination and terminates with the identification and retention of the configural properties of letter and word forms.

Classroom II received visual-perceptual training using the Frostig Horne Visual Perceptual Training Program. The program is intended to provide developmental training in eye-hand coordination, spatial relations, position in space, figure ground, and form constancy.

Classroom III received language-conceptual training using the SRA Learning To Think Series. The program is designed to provide training in the 16 primary

mental abilities originally postulated by Thurstone.

Classroom IV served as a Hawthorne Group in which a resource teacher provided on-going emotional support and encouragement to the regular class teacher, while Class V served as a control gorup in which no specific curricular intervention was instituted.

Following the intervention phase, six measures were administered as post-tests. Table I lists the pre-tests, intervention groups, and post-tests.

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Results

Repeated measures Analyses of Variance were used to test the hypothesis of differential payoff under differential instruction based upon aptitude information. In no case was there a significant aptitude-treatment interaction. Children who earned high scores on the aptitude tests did not profit any more or less than those who earned low scores under differential instruction. Children assigned to Hawthorne and control classes gained as much from pre- to post- test as did children who received specific curricular intervention.

A number of factors are believed to have contributed to the failure to produce significant disordinal interactions. These included (1) non-normal distributions on the aptitude measures, (2) an inability to identify discernably different groups on the basis of the aptitude measures, (3) non-parallelism of pre-test regression lines, and (4) low reliability for the aptitude and post-test measures. The remainder of this paper discusses these matters in more detail.

Traditionally, aptitude-treatment interaction research has been carried out by comparing the differential effect of differential programming for children who earn high scores as opposed to those who earn low scores on some aptitude measure. The actual cut-off scores to be used in identification of these groups is a critical problem. Generally, there are two ways to proceed. A researcher may choose to use the normative data supplied in an aptitude test's manual to place children into groups on the basis of those who earn scores at least one standard deviation above or below the mean for the normative population. The other alternative is to select the top and bottom tertiles of the particular sample distribution one is working with. In both cases, however, non-normal distributions on the pre-test measures creates problems in identification of discernably different groups. In this particular study, both leptokurtic and skewed distributions were obtained on the pre-test measures. Attempts to divide children into groups on the basis of $\pm$ one standard deviation on the tests' normative data were impossible because cell sizes were drastically curtailed. The repeated measures analysis of variance was completed by comparing the top and bottom tertiles on the obtained sample distributions for the pre-tests. This procedure is weak, in that it certainly did not produce discernably different groups. In all cases, the difference between the lowest score in the "high aptitude" groups and the highest score in the "low aptitude" group was minimal. The assumption of normality was violated in the ANOVR analysis.

An ATI analysis in which ANOVR is used to analyze the data assumes comparability of groups prior to institution of treatment procedures. ANOVR assumes homogeneity of within-cell regression and parallelism of pre-test regression lines. To the extent that pre-test regression lines are non-parallel,

differential gains under one teaching strategy may produce parallel regression lines on the post-tests, thus masking an actual aptitude-treatment interaction. A correlation matrix produced on the data collected in this investigation revealed non-parallelism of pre-test regression lines.

It is readily apparent that, in view of the many assumptions underlying ANOVR which were violated in this study, the method of data analysis was inappropriate. Alternatives are available, but are not without problems. Analysis of covariance would control for the problem of non-parallelism of pre-test regression lines. However, analysis of covariance assumes that we are able to identify discernably different groups of children. This assumption could not be met in the present investigation.

Regression analysis appears to be the only solution to the problems encountered in analyzing these data. However, the analysis must account for non-parallelism of pre-test regression lines. This will have to be accomplished by the use of partial regression analyses in which the regression line of each respective post test on the pre-test (aptitude) measures is plotted and the regression of pre-test on pre-test is partialed out. Then, we may conduct F-tests for parallelism of regression lines to test the hypothesis of differential gains as a function of differential aptitude.

Finally, the matter of reliability of aptitude measures must be dealt with. In view of the low reported reliability for aptitude measures, any attempt to compare low aptitude and high aptitude children is extremely risky. When reliability is low, standard error of measurement is high, creating a situation in which a child may be considered strong or weak in a behavioral or ability area simply as a function of chance (see Salvia & Clark, 1973). Again, the method of choice in data analysis appears to be a partial regression analysis.

TABLE I

Pre and Post Tests for the Five Conditions

Pre-Tests	Interventions	Post-Tests
1. Primary Mental Abilities Test	1. Word-Form Training	1. Primary Mental Abilities Test
2. Developmental Test of Visual Perception	2. Frostig Training	2. Developmental Test of Visual Perception
3. Developmental Test of Visual-Motor Integration	3. Learning To Think	3. Developmental Test of Visual-Motor Integration
4. Word-Form Configuration Test	4. Hawthorne	4. Word-Form Configuration Test
	5. Control	5. Peabody-Individual Achievement Test (Reading Recognition)
		6. Peabody Individual Achievement Test (Mathematics)

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